

**PRELIMINARY HYDRAULIC REPORT  
FOR  
PASEO DE LA PLAYA  
SITE 1  
SANTA BARBARA, CALIFORNIA**

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**W. O.** 0189

## **PURPOSE**

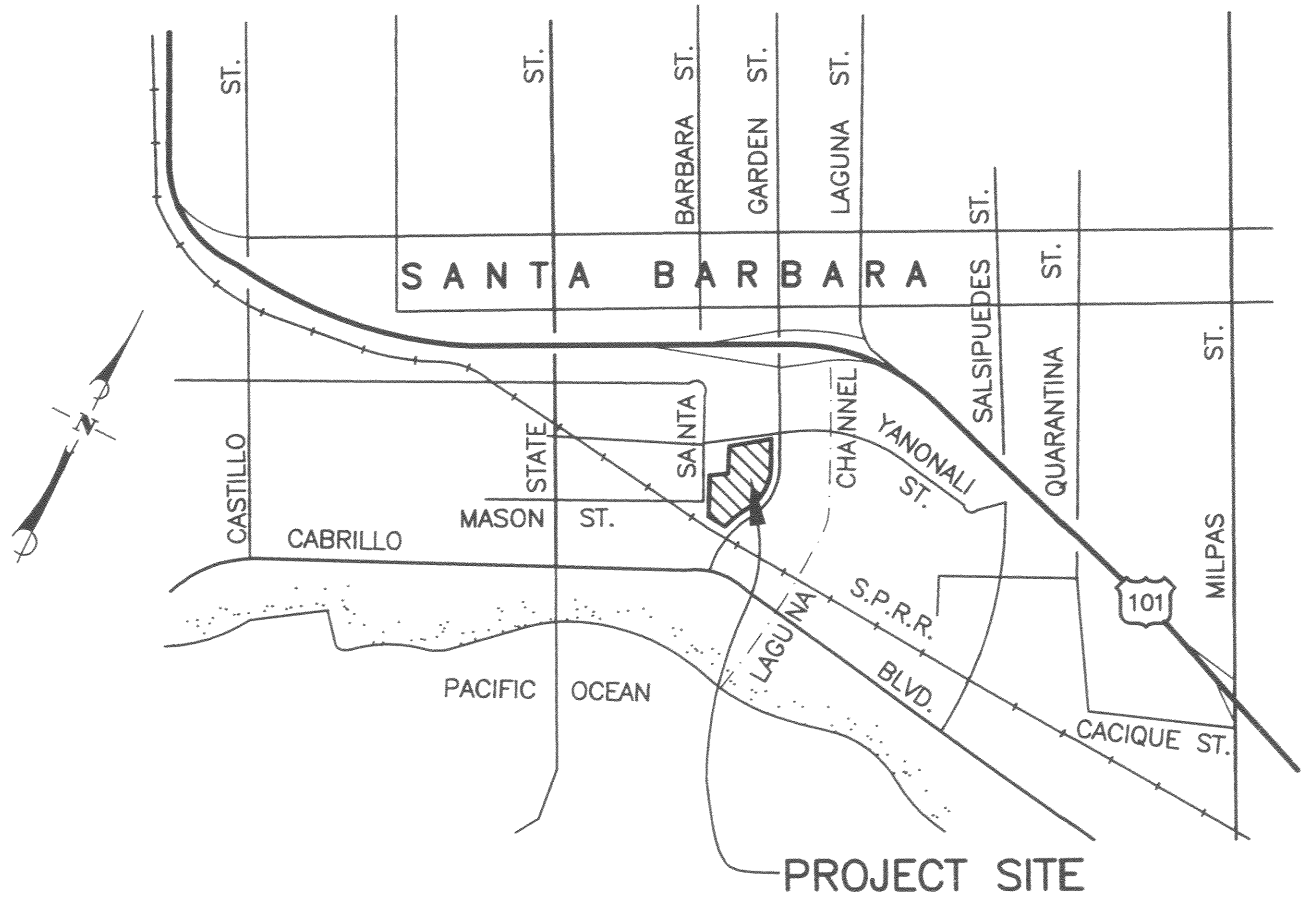
The purpose of this report is to determine the runoff impacts caused by the development of a condominium project consisting of 91 units on the property located at 101 Garden Street.

## **PROPOSED DEVELOPMENT**

The proposed project is located on a 4.52 acre site and consists of a condominium development. The property is currently occupied by a variety of commercial and industrial uses, primarily related to open storage, fabrication, contractor yards, moving and automobile repair with a considerable amount of impervious surfaces including parking lots and access roadways. The parcel size is 4.52 acres and has 3.41 acres of impervious surface and 1.11 acres of pervious surface. The storm drain system which was constructed in 1997 as part of the City's Garden Street Extension project (City Dwg. No. C-1-3917) was designed to carry storm water runoff from this site. An 18" reinforced concrete pipe stub (RCP) was constructed on the westerly drop inlet north of the railway and an 18" RCP was placed at the proposed entrance to the condominium project on Garden Street to facilitate connection of the future storm drain system.

The development proposed for this site consists of 91 condominium units, underground parking and a children's play area. It is 4.52 acres and is composed of 2.71 acres of impervious surface (building, access roads, walkways, etc.) and 1.81 acres of landscaping. The post development runoff from this parcel will continue to flow to the existing storm drain systems in Garden Street. All storm water runoff from this parcel will eventually flow to Laguna Channel. Figure 1 is a vicinity map depicting Site 1 of the development area.

Appendix A contains a plan delineating the pre and post-development conditions for the site.



## VICINITY MAP

NO SCALE

FIGURE 1  
SITE 1

## **HYDROLOGY**

The pre- and post- development storm water runoff was calculated using the Santa Barbara County Flood Control District (SBCFCD) Rational Method computer program for 100, 50, 25 and 10 year return period storm events. The minimum time of concentration of 12 minutes was used for all return period storm events.

Runoff coefficients for the pre- and post- development conditions were determined by calculating a weighted coefficient of runoff. The coefficient for those areas which we maintained as open space or landscaping are taken from the SBCFCD Rational Method computer program. The coefficient of runoff for all impervious areas such as roof, hardscape and paved areas will be 0.90. The factors to be used to calculate the weighted coefficient of runoff are as follows:

Return Period, yr	C, Pervious Areas	C, Impervious Areas
100	0.74	0.90
50	0.72	0.90
25	0.68	0.90
10	0.62	0.90

### **PRE – DEVELOPMENT RUNOFF**

The area of the site is 4.52 acres and contains approximately 3.41 acres of impervious surfaces such as roofs, pavement, walkways and other hardscape. The remainder of the site, 1.11 acres, is pervious surfaces such as open space or landscaping.

The weighed coefficient of runoff for the various return period storm events is as follows:

$$\begin{aligned}C_{100} &= ((3.41) (0.90) / 4.52) + ((1.11) (0.74) / 4.52) \\&= (3.07 / 4.52) + (0.82 / 4.52) \\&= 0.68 + 0.18\end{aligned}$$

$$C_{100} = 0.86$$

$$\begin{aligned}C_{50} &= ((3.41) (0.90) / 4.52) + ((1.11) (0.72) / 4.52) \\&= (3.07 / 4.52) + (0.80 / 4.52) \\&= 0.68 + 0.18\end{aligned}$$

$$C_{50} = 0.86$$

$$\begin{aligned}C_{25} &= ((3.41) (0.90) / 4.52) + ((1.11) (0.68) / 4.52) \\&= (3.07 / 4.52) + (0.75 / 4.52) \\&= 0.68 + 0.17\end{aligned}$$

$$C_{25} = 0.85$$

$$\begin{aligned}C_{10} &= ((3.41) (0.90) / 4.52) + ((1.11) (0.62) / 4.52) \\&= (3.07 / 4.52) + (0.69 / 4.52) \\&= 0.68 + 0.15\end{aligned}$$

$$C_{10} = 0.83$$

Appendix A contains the pre-development topographic map which delineates the existing impervious areas. Appendix B contains the SBCFCD Rational Method computer printout using the weighted coefficients of runoff and a time of concentration of 12 minutes.

Hand calculations of the pre-development runoff using the rational method formula ( $Q = CiA$ ) with the weighted coefficient of runoff and the SBCFCD identified rainfall intensities will allow the runoff to be calculated to the nearest tenth of a CFS. Hand calculations yield the following results.

Return Period, yr	Weighted C	Rainfall Intensity, I	Area, Acres	Q
100	0.86	4.03	4.52	15.7
50	0.86	3.68	4.52	14.3
25	0.85	3.18	4.52	12.2
10	0.83	2.61	4.52	9.8

## **POST – DEVELOPMENT RUNOFF**

The area of the post-development site is 4.52 acres and is composed of 2.71 impervious surfaces such as roofs, pavement, walkways and other hardscape and 1.81 acres of pervious surfaces such as landscaped areas. For the purpose of this analysis, a runoff coefficient of 0.90 will be used for the post development condition.

The weighed coefficient of runoff for the various return period storm events is as follows:

$$\begin{aligned}C_{100} &= ((2.71) (0.90) / 4.52) + ((1.81) (0.74) / 4.52) \\&= (2.44 / 4.52) + (1.34 / 4.52) \\&= 0.54 + 0.30\end{aligned}$$

$$C_{100} = 0.84$$

$$\begin{aligned}C_{50} &= ((2.71) (0.90) / 4.52) + ((1.81) (0.72) / 4.52) \\&= (2.44 / 4.52) + (1.30 / 4.52) \\&= 0.54 + 0.29\end{aligned}$$

$$C_{50} = 0.83$$

$$\begin{aligned}C_{25} &= ((2.71) (0.90) / 4.52) + ((1.81) (0.68) / 4.52) \\&= (2.44 / 4.52) + (1.23 / 4.52) \\&= 0.54 + 0.27\end{aligned}$$

$$C_{25} = 0.81$$

$$\begin{aligned}C_{10} &= ((2.71) (0.90) / 4.52) + ((1.81) (0.62) / 4.52) \\&= (2.44 / 4.52) + (1.12 / 4.52) \\&= 0.54 + 0.25\end{aligned}$$

$$C_{10} = 0.79$$

Appendix A contains the post-development tributary area map which delineates the proposed impervious areas. Appendix C contains the SBCFCD Rational Method computer printout using the weighted coefficient of runoff and a time of concentration of 12 minutes.

Hand calculations of the post-development runoff using the rational method formula ( $Q = CiA$ ) with the weighted coefficient of runoff and the SBCFCD identified rainfall intensities will allow the runoff to be calculated to the nearest tenth of a CFS. Hand calculations yield the following results.

Return Period, yr	Weighted C	Rainfall Intensity, I	Area, Acres	Q
100	0.84	4.03	4.52	15.3
50	0.83	3.68	4.52	13.8
25	0.81	3.18	4.52	11.6
10	0.79	2.61	4.52	9.3



### **PRE – VS POST – DEVELOPMENT RUNOFF**

The following table is a recap of the results of the pre- and post-development runoff and indicates the change in runoff due to the proposed development.

Return Period, yr	Pre-development Runoff, cfs	Post-development Runoff, cfs	Change cfs
100	15.7	15.3	-0.4
50	14.3	13.8	-0.5
25	12.2	11.6	-0.6
10	9.8	9.3	-0.5

## **CONCLUSIONS**

The proposed development of a condominium development will slightly decrease runoff from the site, therefore there will be no adverse effect on downstream storm drain facilities.

## **SITE STORM DRAIN DESIGN**

### **TRIBUTARY AREA "A"**

Tributary Area "A" contains 1.21 acres and will drain the roof, walk and some landscaped areas of the site. Stormwater runoff from this area will be conveyed to the existing 18" storm drain pipe in a 12" smooth bore HDPE storm drain pipe. The stormwater runoff for the 25 year return period storm event is as follows:

$$\begin{aligned} Q_{25} &= C i A & C &= 0.81 \\ &= (0.81) (3.18) (1.21) & i &= 3.18 \text{ in/hr} \\ Q_{25} &= 3.1 \text{ cfs} & A &= 1.21 \text{ AC} \end{aligned}$$

The results of the SBCFCD full flow storm drain hydraulic computer run indicates that a twelve (12) inch diameter pipe will handle the 25 year return period storm water runoff of 3.1 cfs. The following page is the computer printout from the run of the SBCFCD full flow storm drain hydraulics computer program. The project therefore will utilize an 12" HDPE smooth bore storm drain pipe to carry storm water runoff from Tributary Area "A" to the existing 18" storm drain pipe. The preliminary drainage plan contained in Appendix A delineates the proposed storm drain for Tributary Area "A".

06-12-2006

SANTA BARBARA COUNTY FLOOD CONTROL DISTRICT FULL FLOW STORMDRAIN PIPE HYDRAULICS

Station (ft)	Pipe Length	PipeD (in)	n	Flow (cfs)	Vel (ft/sec)	H(v) (ft)	S(f) (ft/ft)	HGL (ft)	EL (ft)
Tailwater		[Downstream HGL]						0.00	
0								0.00	0.24
100	100	12	0.013	3.1	3.95	0.24	0.00757		
100								0.76	1.00
End of Run @ Headwater								1.05	1.05

## TRIBUTARY AREA “B”

Tributary Area “B” contains 2.90 acres and will drain the roof, walk and some landscaped areas of the site. Stormwater runoff from this area will be conveyed to the existing 18” storm drain pipe in an 18” smooth bore HDPE storm drain pipe. The stormwater runoff for the 25 year return period storm event is as follows:

$$\begin{aligned} Q_{25} &= C i A & C &= 0.81 \\ &= (0.81) (3.18) (2.91) & i &= 3.18 \text{ in/hr} \\ Q_{25} &= 7.5 \text{ cfs} & A &= 2.90 \text{ AC} \end{aligned}$$

The results of the SBCFCD full flow storm drain hydraulic computer run indicates that a twelve (12) inch diameter pipe will handle the 25 year return period storm water runoff of 7.5 cfs. The following page is the computer printout from the run of the SBCFCD full flow storm drain hydraulics computer program. The project therefore will utilize an 18” HDPE smooth bore storm drain pipe to carry storm water runoff from Tributary Area “B” to the existing 18” storm drain pipe. The preliminary drainage plan contained in Appendix A delineates the proposed storm drain for Tributary Area “B”.

06-12-2006

SANTA BARBARA COUNTY FLOOD CONTROL DISTRICT FULL FLOW STORMDRAIN PIPE HYDRAULICS

Station	Pipe Length (ft)	PipeD (in)	n	Flow (cfs)	Vel (ft/sec)	H(v) (ft)	S(f) (ft/ft)	HGL (ft)	EL (ft)
Tailwater		[Downstream HGL] .....						0.00	
0								0.00	0.28
82	82	18	0.013	7.5	4.24	0.28	0.00510		
								0.42	0.70
End of Run @ Headwater		.....						0.75	0.75

## TRIBUTARY AREA "C"

Tributary Area "C" contains 0.41 acres and will drain the roof, walk and some landscaped areas of the site. Stormwater runoff from this area will flow overland to the proposed biofilter swale located along the top of the easterly bank of Laguna Channel. The project proposed a swale three (3) feet wide with 4:1 side slopes, a depth of six (6) inches and a slope of 0.25% to carry the 25 year return period storm event from Tributary Area "C". The stormwater runoff for the 25 year return period storm event is as follows:

$$\begin{aligned} Q_{25} &= C i A & C &= 0.81 \\ &= (0.81) (3.18) (0.41) & i &= 3.18 \text{ in/hr} \\ Q_{25} &= 1.1 \text{ cfs} & A &= 0.41 \text{ AC} \end{aligned}$$

The results of the SBCFCD open channel flow hydraulics computer run indicates that the proposed 3' wide drainage swale at 0.25% will carry the 25 year return period storm water runoff of 1.1 cfs. The following page is the computer printout from the run of the SCFCD open channel flow hydraulics computer program. The proposed biofilter swale will therefore be adequate to carry stormwater runoff from Tributary Area "C".

SANTA BARBARA COUNTY FLOOD CONTROL DISTRICT - OPEN CHANNEL FLOW HYDRAULICS

Program: C H A N N E L . B A S

Licensed to MAC Design Associates

PROJECT: Paseo de la Playa - Site 1 BY: MAC DATE: 06-12-2006

Flow in TRAPEZOIDAL Channel

Q = 1 cfs, b = 3.0 ft, z = 4.00, n = 0.030 So = 0.00250

Normal Depth = 0.29 ft

Normal Vel = 0.91 ft/sec

V\*V/2G = 0.01 ft

V\*V/2G+Depth = 0.30 ft

P + M = 0 cu-ft

Froude Nr. = 0.34

Critical Depth = 0.15 ft

Mild Slope, 'M' Profiles

Flow is in Unstable Zone. S(O)/S(C) = 0.10

Wave Height = 0.00 ft, D(n)+Wave = 0.29 ft



## **BEST MANAGEMENT PRACTICE**

The proposed development proposes to construct a biofilter along the easterly edge of the site. Design criteria for the biofilter will be a 1" storm drain if the biofilter is designed as a detention basin or 0.25" per hour for a four (4) hour period if the biofilter is designed as a flow through treatment system.

**APPENDIX A**

**PRE-DEVELOPMENT TOPOGRAPHIC MAP  
AND  
POST-DEVELOPMENT TRIBUTARY AREA PLAN**

## **APPENDIX B**

### **PRE-DEVELOPMENT RATIONAL METHOD COMPUTER PRINTOUT**



## **APPENDIX C**

### **POST-DEVELOPMENT RATIONAL METHOD COMPUTER PRINTOUT**

# Santa Barbara County Flood Control and Water Conservation District

## Program Rational - XL

### User Data:

<b>Project Name:</b>	PASEO DE LA PLAYA	<b>Project Number:</b>	0189
<b>Date of Run:</b>	6/12/2006	<b>Run By:</b>	MAC
<b>Notes:</b>	SITE 1 - POST-DEVELOPMENT RUNOFF		

### Input Data:

<b>Location:</b>	South Coast	<b>Land Use Type:</b>	Condo - Apartments
<b>Area (Acres):</b>	4.52	<b>Time of Concentration (Min.):</b>	12
<b>Calculated Runoff Coefficient:</b>	Q10: 0.70	Q25: 0.74	Q50: 0.77
<b>User Selected Runoff Coefficient (Optional):</b>	0.79	0.81	0.83
			Q100: 0.79
			0.84
			<b>Calculate</b>

### For Large Lot Subdivisions (>10,000 sq. ft.):

	Low Value:	High Value:	User Selected:
Q10:			
Q25:			
Q50:			
Q100:			

**Enter Selection**

### Results:

	Rainfall Intensity:	Runoff Coef:	Q (cfs):
Q10:	2.61	0.79	9
Q25:	3.18	0.81	12
Q50:	3.68	0.83	14
Q100:	4.03	0.84	15

**View RI Curves** **Print**

**View RC Curves** **Exit**

# Santa Barbara County Flood Control and Water Conservation District

## Program Rational - XL

### User Data:

<b>Project Name:</b>	PASEO DE LA PLAYA	<b>Project Number:</b>	0189
<b>Date of Run:</b>	6/12/2006	<b>Run By:</b>	MAC
<b>Notes:</b>	SITE 1 - PRE-DEVELOPMENT RUNOFF		

### Input Data:

<b>Location:</b>	South Coast	<b>Land Use Type:</b>	Condo - Apartments
<b>Area (Acres):</b>	4.52	<b>Time of Concentration (Min.):</b>	12
<b>Calculated Runoff Coefficient:</b>	Q10: 0.70	Q25: 0.74	Q50: 0.77
<b>User Selected Runoff Coefficient (Optional):</b>	0.83	0.85	0.86
			Q100: 0.79
			0.86
<b>Calculate</b>			

### For Large Lot Subdivisions (>10,000 sq. ft.):

	Low Value:	High Value:	User Selected:
Q10:			
Q25:			
Q50:			
Q100:			

**Enter Selection**

### Results:

	Rainfall Intensity:	Runoff Coef:	Q (cfs):
Q10:	2.61	0.83	10
Q25:	3.18	0.85	12
Q50:	3.68	0.86	14
Q100:	4.03	0.86	16

**View RI Curves**      **Print**  
**View RC Curves**      **Exit**